Memo: Run13 RICH readiness

Taku Gunji

Center for Nuclear Study, the University of Tokyo

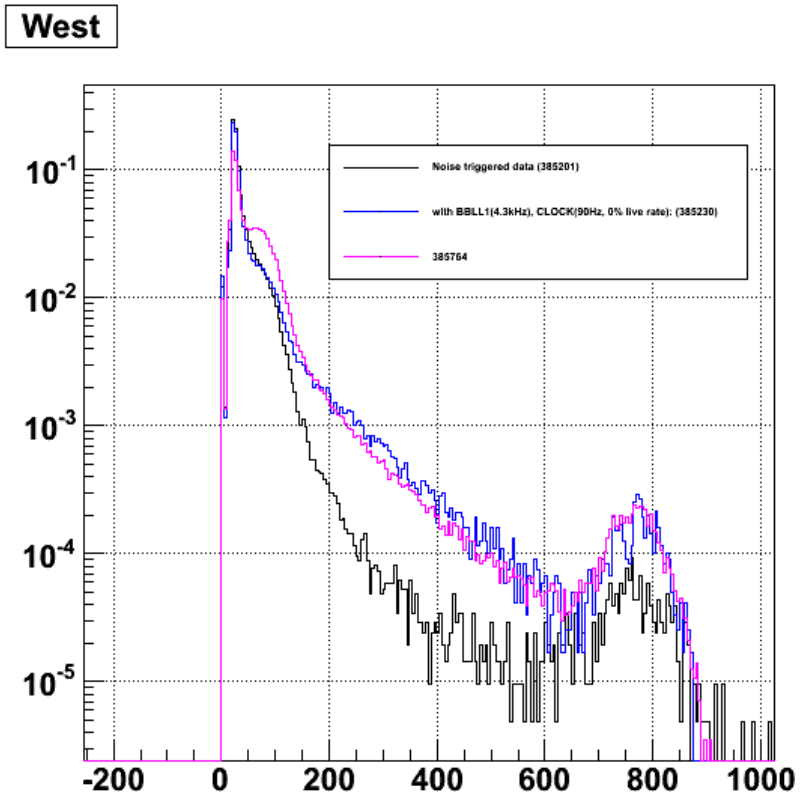
March 5, 2013

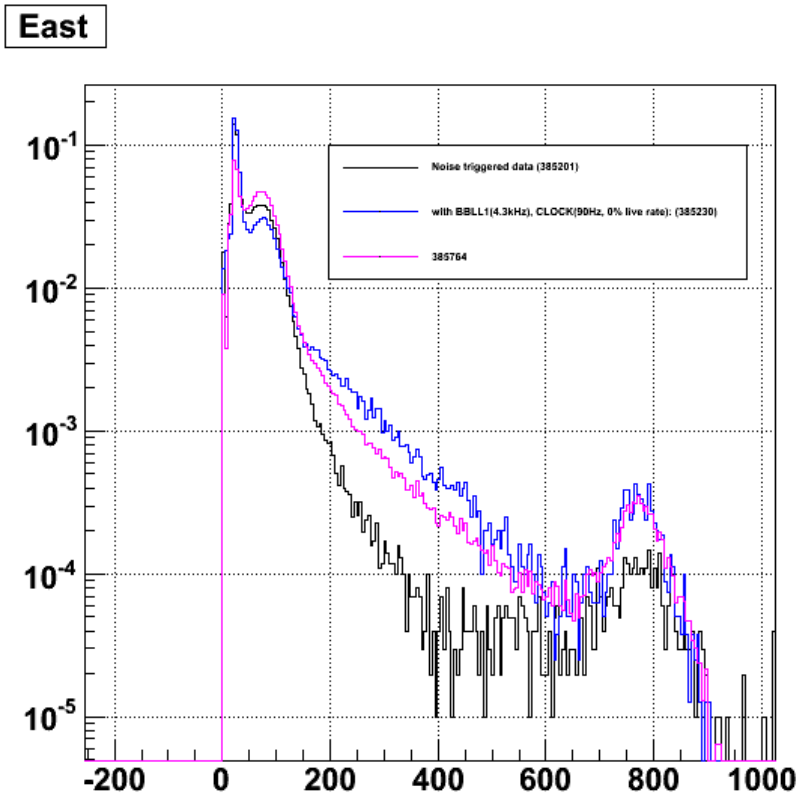
Status of RICH-I

- Short summary of RICH status by Akimoto-kun
  - *https://www.phenix.bnl.gov/cdsagenda/fullAgenda.php?ida=a13142*
  - *http://phenix.cns.s.u-tokyo.ac.jp/~r.akimoto/status_report/status_report20130208.pdf*
- Check the collision data to see whether the current GTM (LVL1 Delay) setting is ok
- Runs taken on 28.2.2013 and 3.3.2013. Use 50k events with different trigger combinations.
  - 385201: noise trigger, scaled 7kHz (35% live rate)
  - 385230: BBLL1 trigger (scaled 4.3kHz, 95%), clock trigger (scaled 90Hz, 0%)
  - 385764: All triggers are fully commissioned. Trigger mix (BBLL1, ERTLL1, MUIDLL1, MUTRIG...)
    - Scaled:BBLL1(narrow)=300Hz, ERTLL1_E&BBLL1(narrow)=351Hz, MPC&ERT_2x2=431Hz, SG&RPC3&MUID=508Hz, Live time=40%

Status of RICH-II

- Left: West (LVL1 Delay=3), Right:East (LVL1 Delay=4)
- Collisional signals from RICH



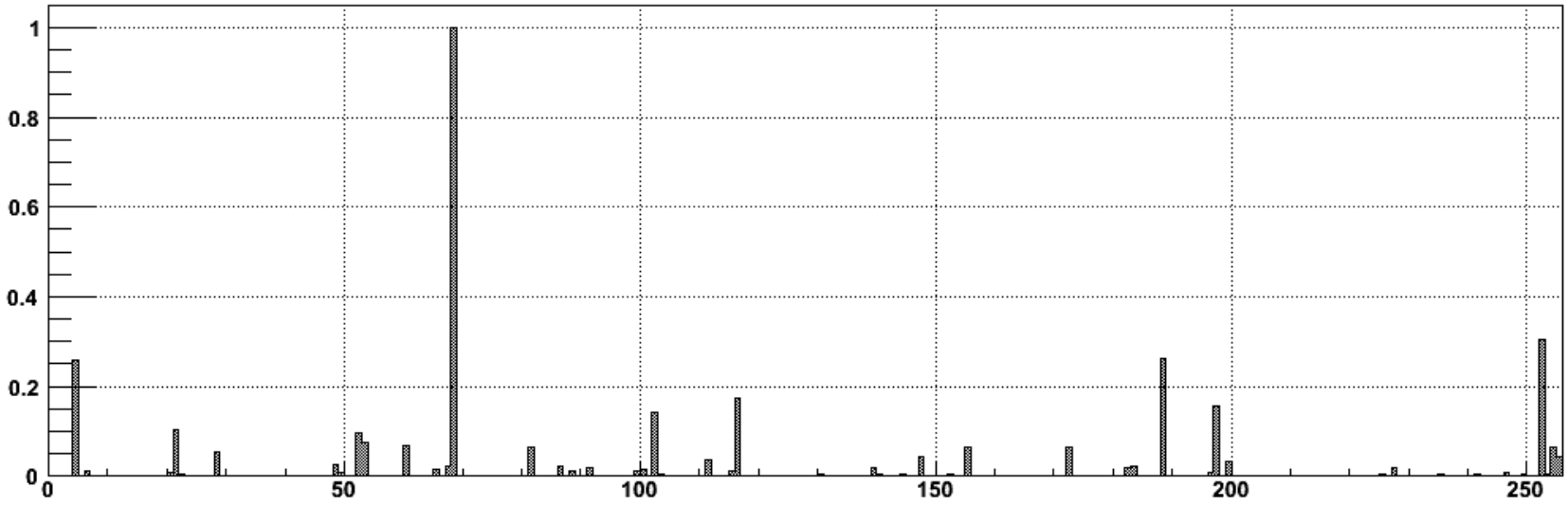


Status of ERT-RICH Trigger

- Check hot channels for mask and turn-on curves for each channel. (256 channel)
- 385230: BBLL1 trigger (scaled 4.3kHz, 95%), clock trigger (scaled 90Hz, 0%)
  - 2M events inspected for this study
  - 25 masked channels (version at the end of run12).
- 385764: Trigger mix (BBLL1, ERT, MUIDLL1, MUTRG, MPC, etc)
  - First run after new channel mask setting (385408 and 385599)
  - Event rejection of ERTLL1_E = 430 (due to hot channels in EMCal_2x2)
- 385768: (Quick) Feed RICH and ERT
  - to check how feed improves trigger turn-on-curves...
  - EMCal_2x2 hot channel gone. Event rejection = 940
- 385355, 385408, 385599: noise data without any ERT masks
  - 300k events inspected to check noisy channels.
  - Determine the hot channels for the ERT channel masks.

Hot channels from run 385408 and 385599

- Hot channels: $N_{trig}/N_{evt} \geq 0.05$.
- 16 channels are identified and applied as masks after the run 385772

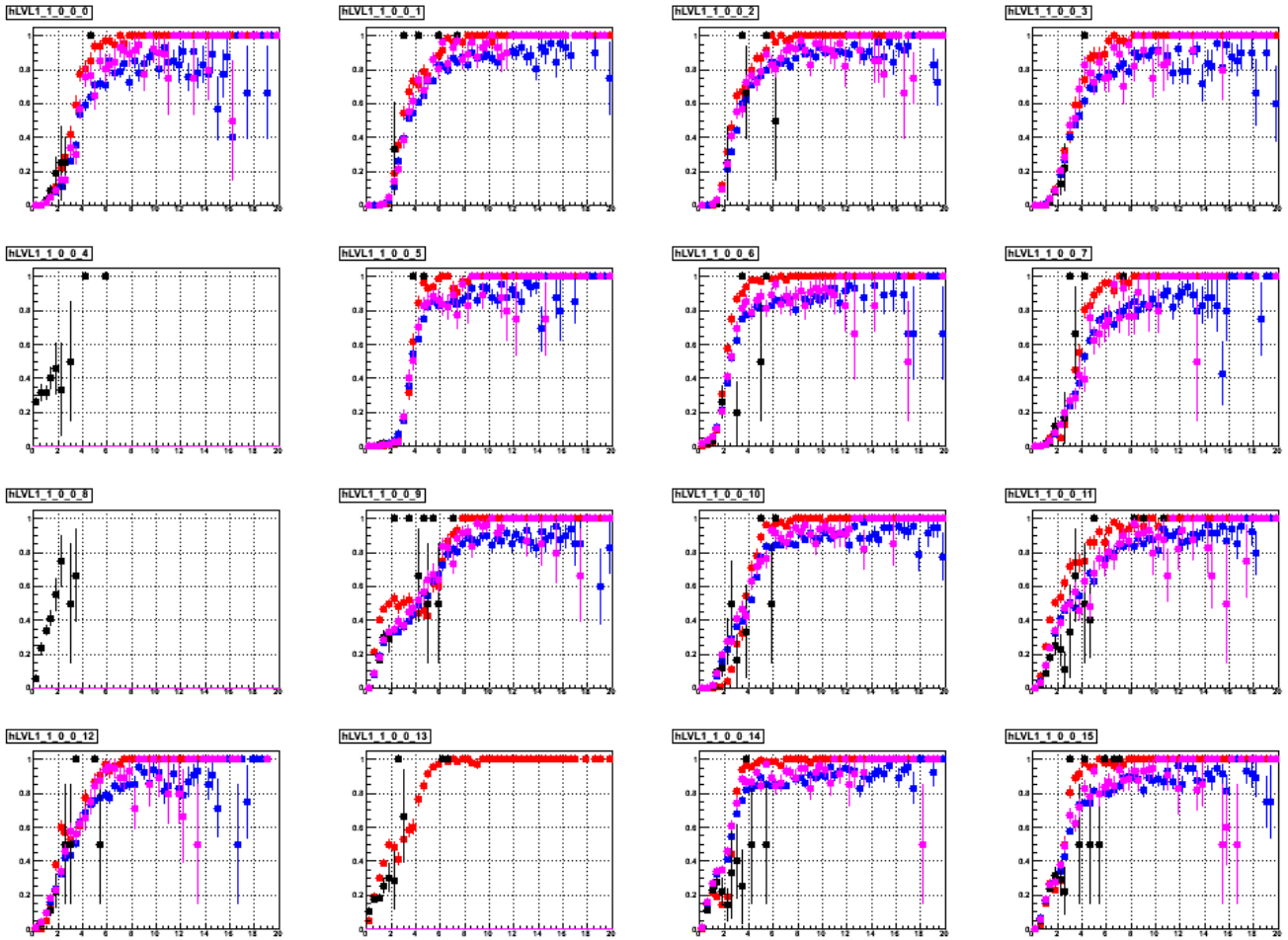


Hot channel list

SM Number	Ratio	Arm	Sect	SM	Loc	Channel
4 (W0 SM4)	0.259	0	0	4	WS0	4
21 (W0 SM21)	0.105	0	0	21	WS0	13
28 (W0 SM28)	0.055	0	0	28	WS0	8
52 (W1 SM20)	0.098	0	1	20	WS1	12
53 (W1 SM21)	0.077	0	1	21	WS1	13
60 (W1 SM28)	0.066	0	1	28	WS1	8
68 (W2 SM4)	1	0	2	4	WS2	4
81 (W2 SM17)	0.063	0	2	17	WN2	14
102 (W3 SM6)	0.143	0	3	6	WS3	6
116 (W3 SM20)	0.175	0	3	20	WS3	12
155 (E0 SM27)	0.065	1	0	27	ES0	8
172 (E1 SM12)	0.064	1	1	12	EN1	0
188 (E1 SM28)	0.262	1	1	28	EN1	8
197 (E2 SM5)	0.155	1	2	5	EN2	5
252 (E3 SM28)	0.305	1	3	28	EN3	8
254 (E3 SM30)	0.064	1	3	30	EN3	10

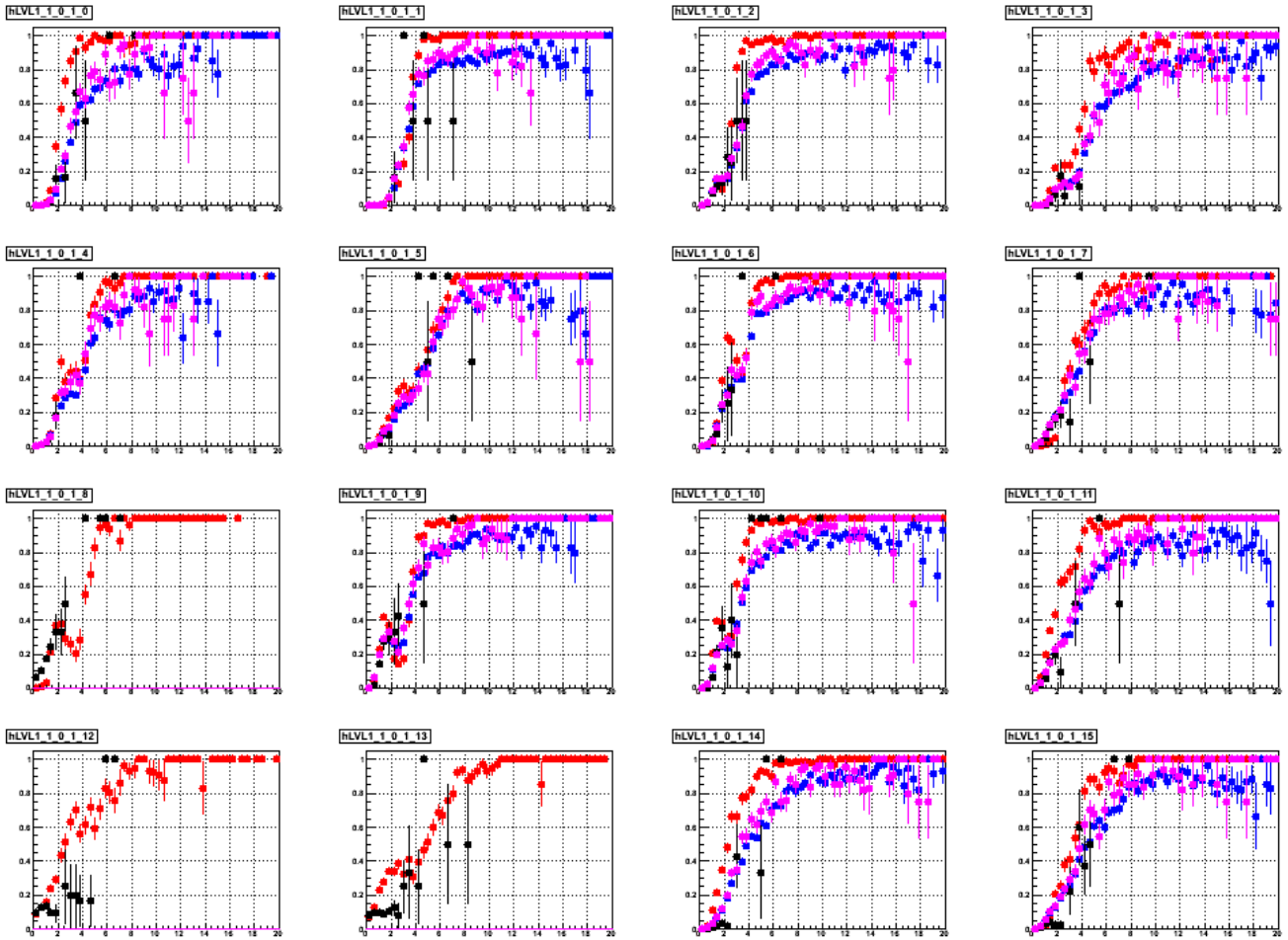
ERT-RICH: WS0

- Upper left of WS. Board Number = 0. Vth=920
- No data channels = 4 and 8 (due to the mask in 385230.)
- Hot channels ($N_{hit}/N_{evt} \geq 0.05$): 4, 8, and 13 (from 385408)



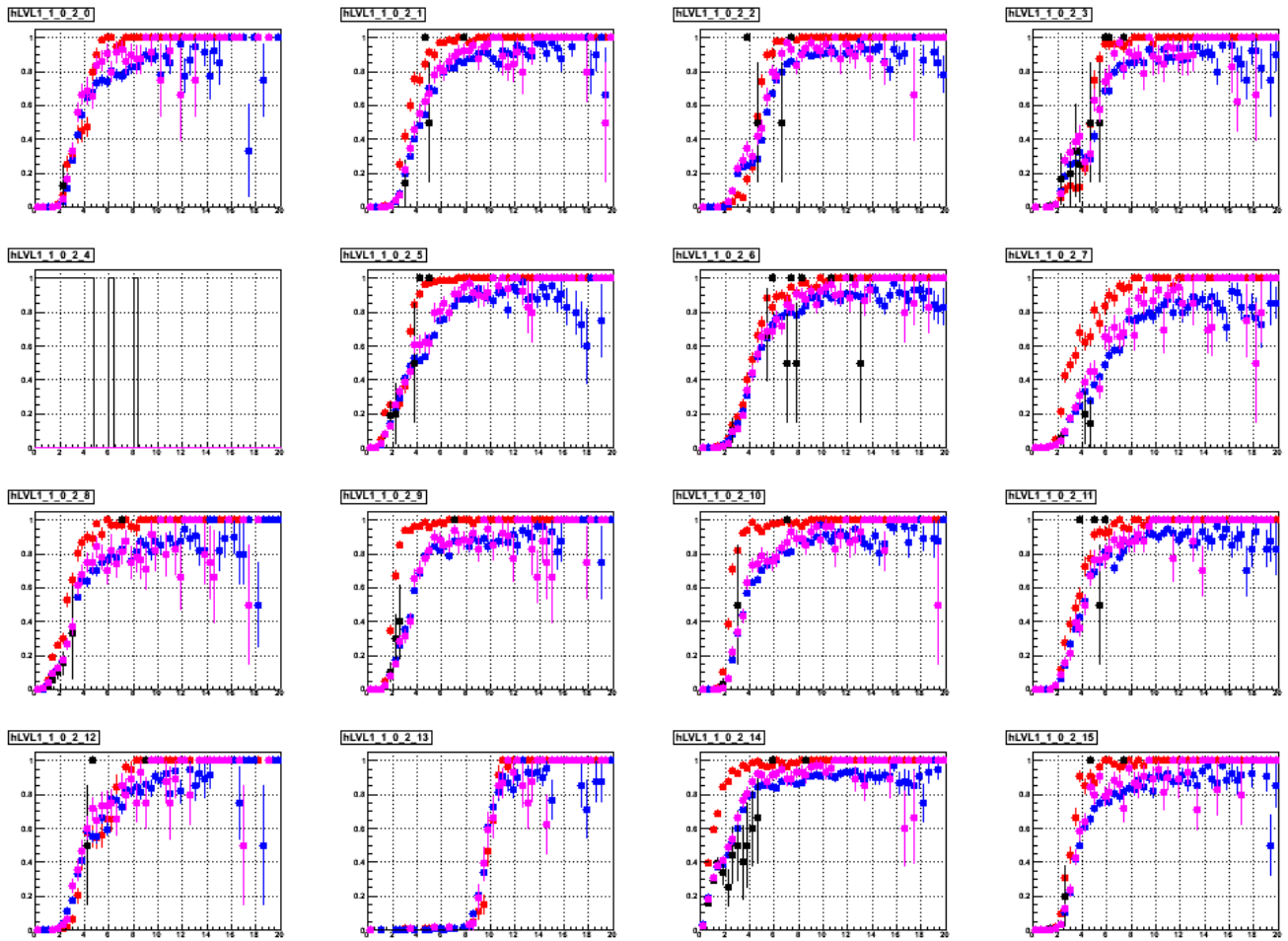
ERT-RICH: WS1

- Upper right of WS. Board Number = 15. Vth=920
- No dead channles
- Hot channels: 8, 12, and 13 (from 385408)



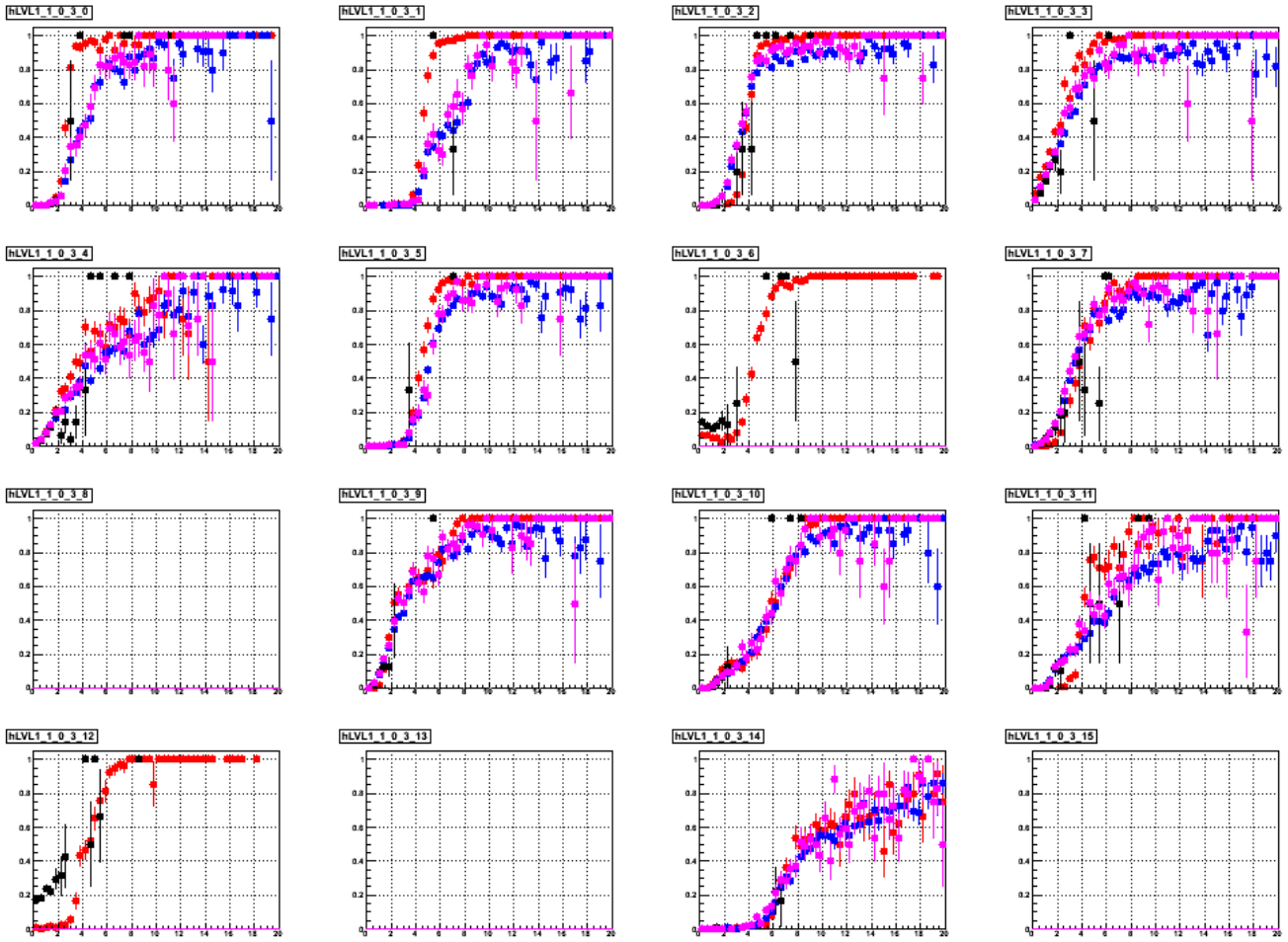
ERT-RICH: WS2

- Lower left of WS. Board Number = 17. Vth=920
- No data channels = 4 (due to the mask in 385230.)
- Hot channels : 4 (from 385408)



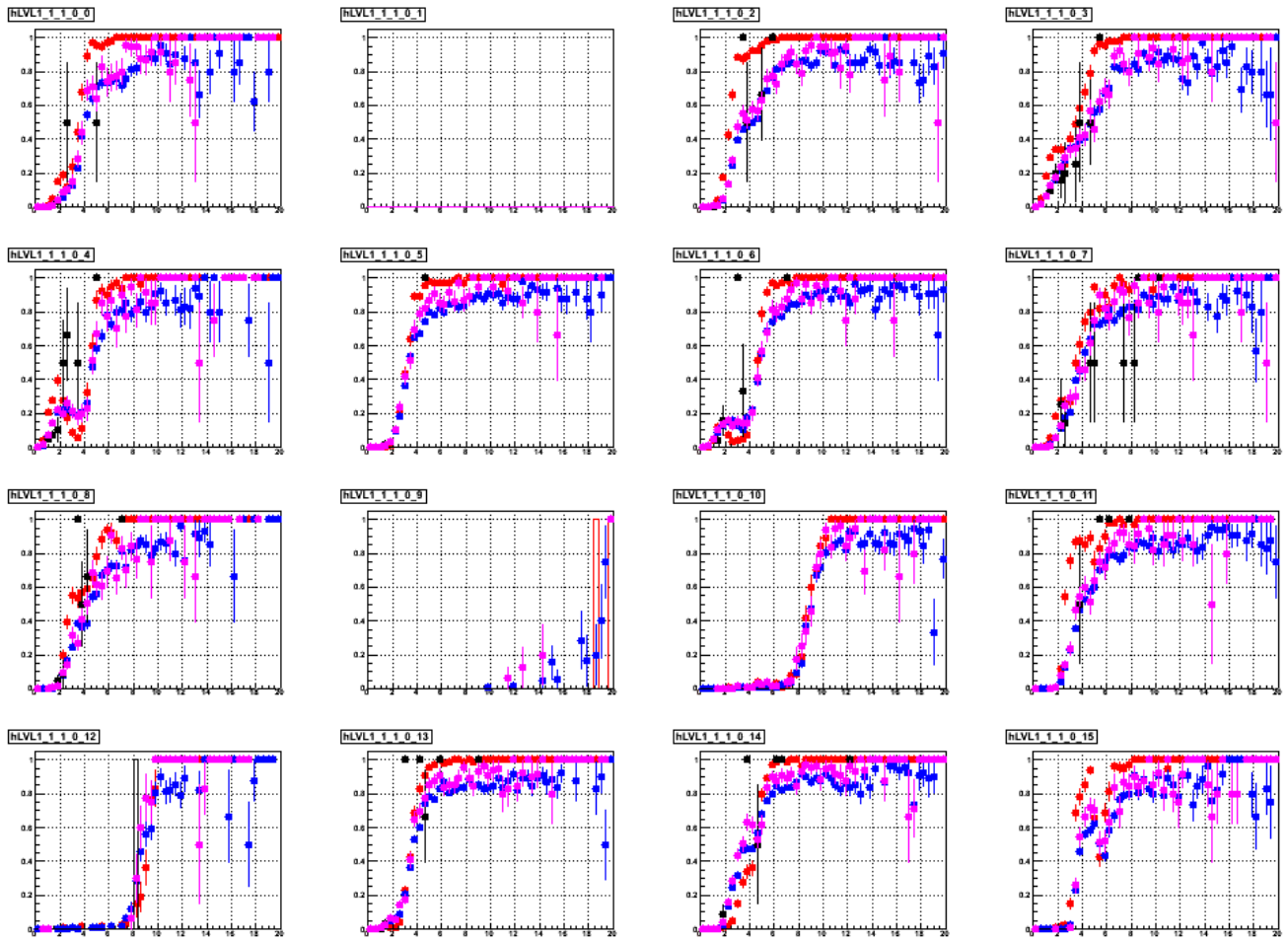
ERT-RICH: WS3

- Lower right of WS. Board Number = 20. Vth=920
- No data channles = 8, 13, 15 (no data in 385355, either)
- Hot channels = 6, 12 (from 385408)



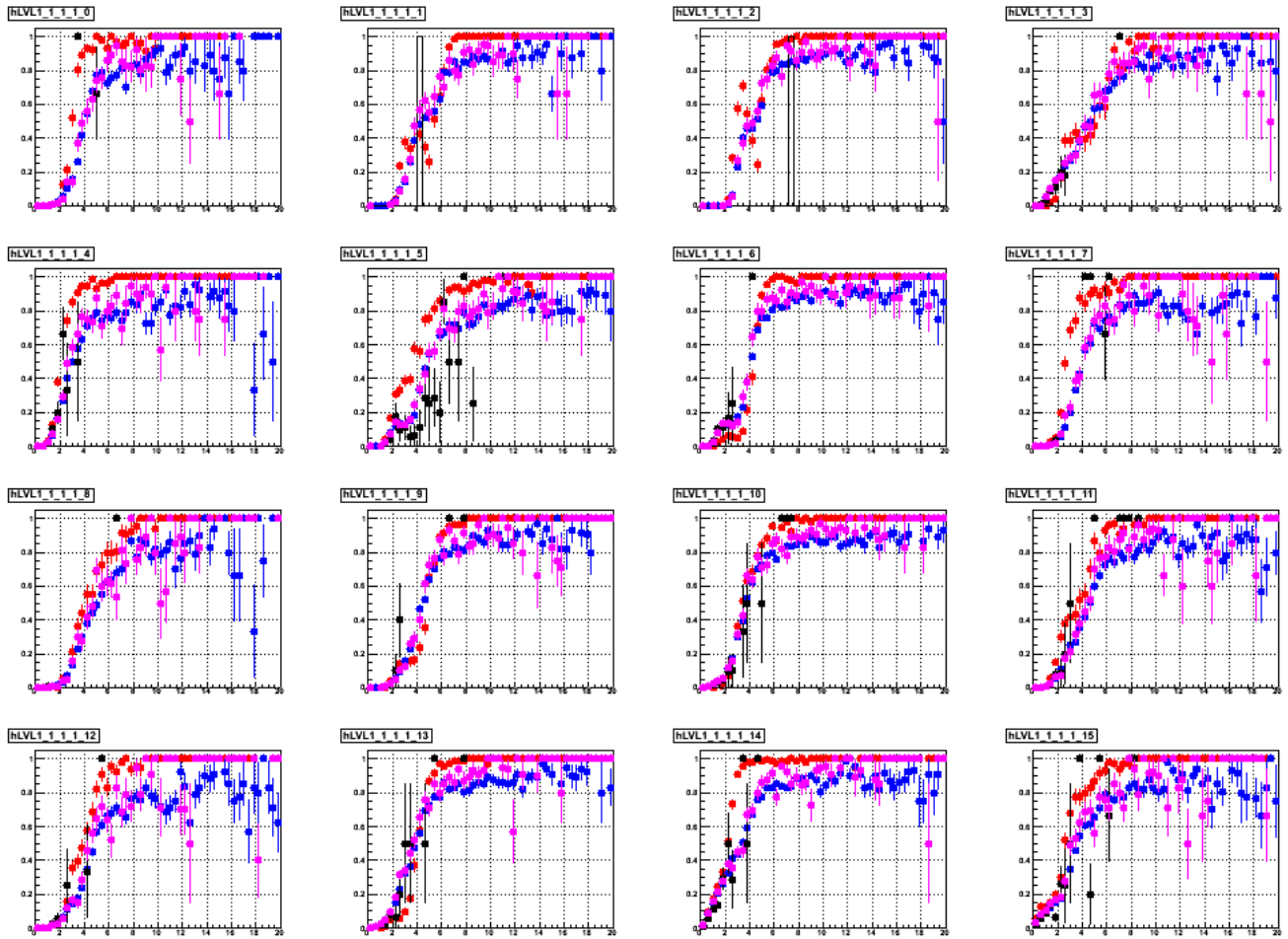
ERT-RICH: WN0

- Upper left of WN. Board Number = 01. Vth=920
- No data channles = 1, 9 (no data in 385355, either)
- No hot channels



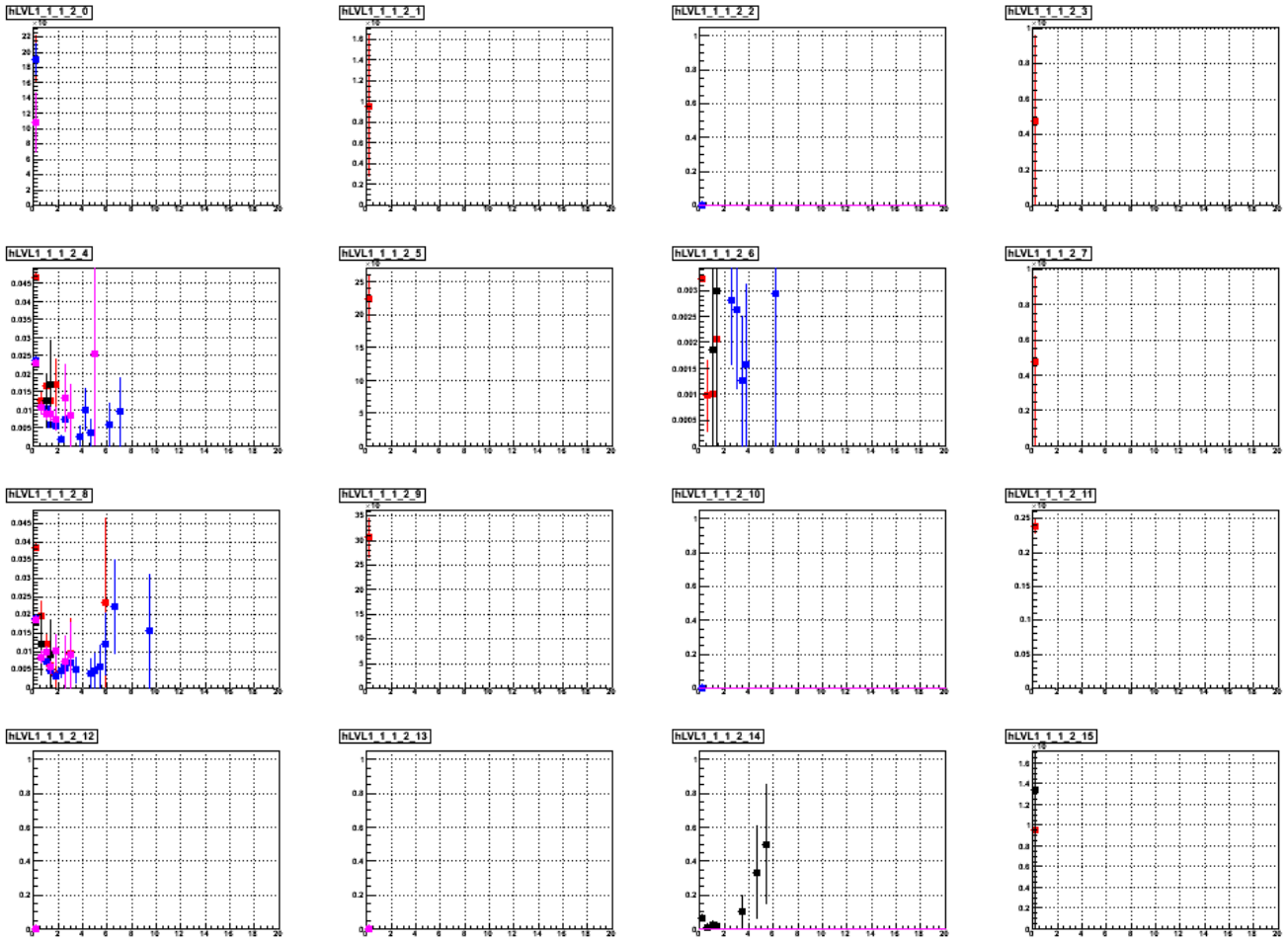
ERT-RICH: WN1

- Upper right of WN. Board Number = 13. Vth=920
- No dead channles
- No hot channles



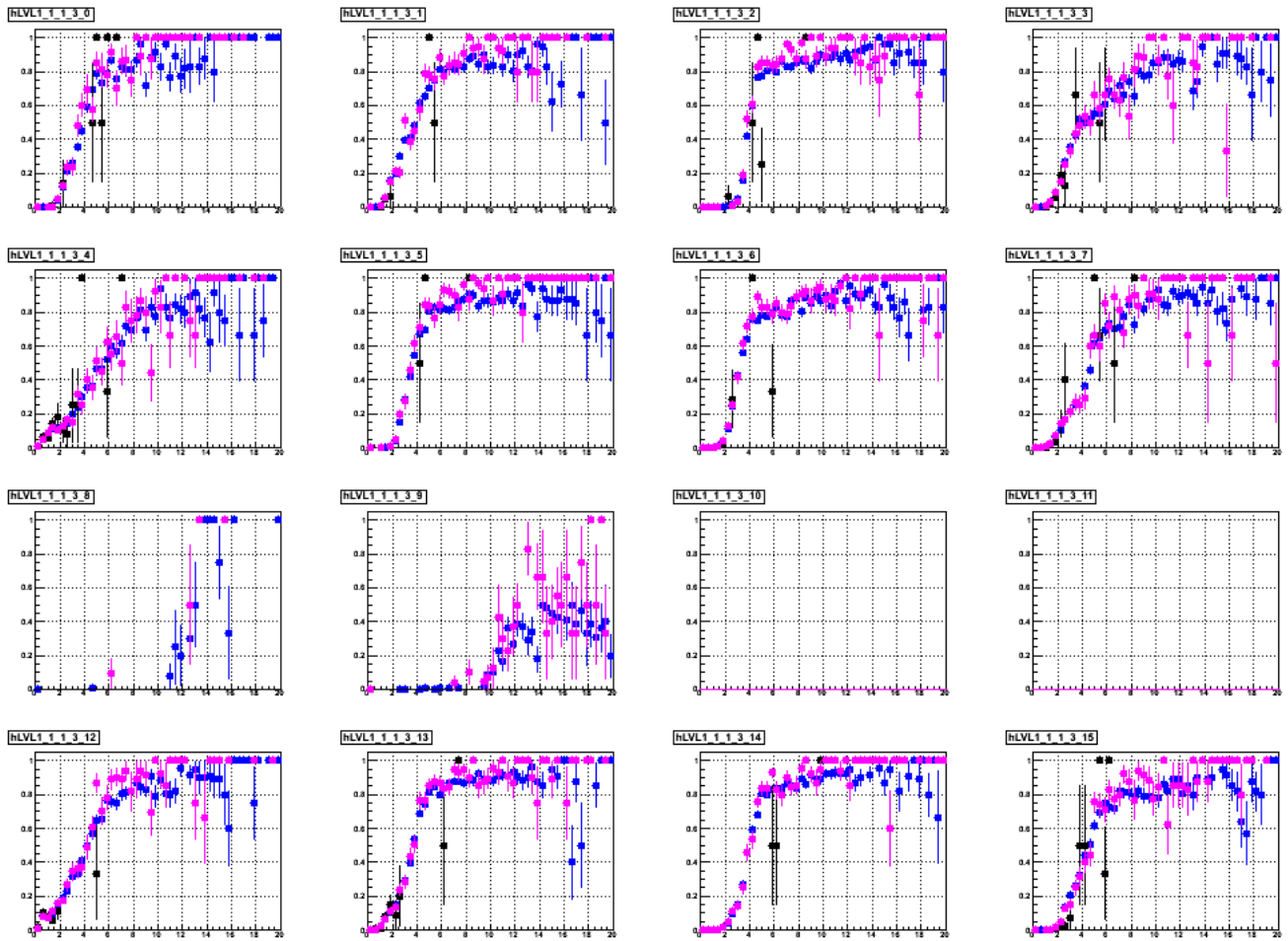
ERT-RICH: WN2

- Lower left of WN. Board Number = 31. Vth=920
- Dead channles (not functional channels) = ALL
- Hot channels: 14 (from 385408)



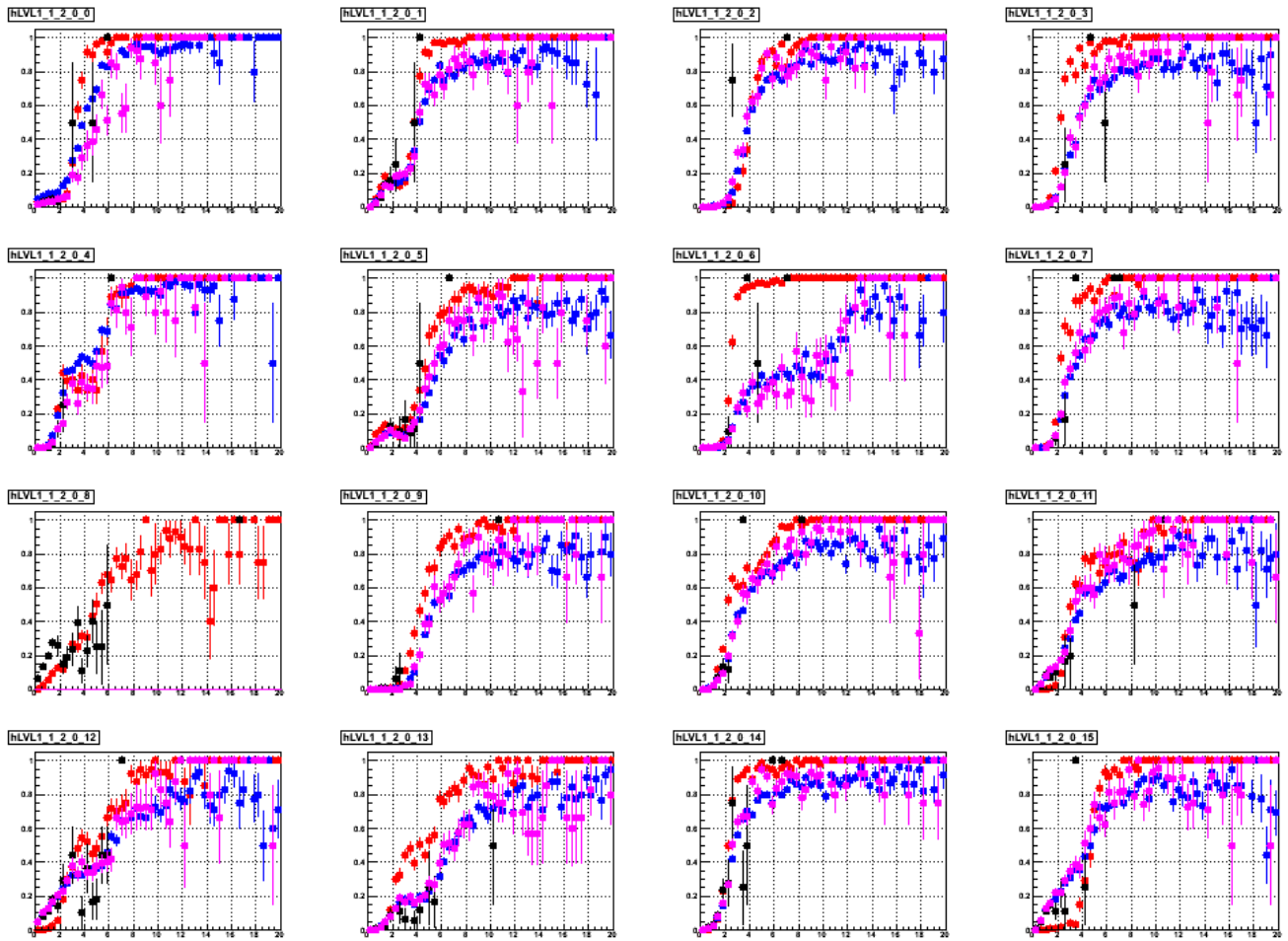
ERT-RICH: WN3

- Lower right of WN. Board Number = 08. Vth=920
- No data channles = 9, 11
- No hot channels (from 385355)



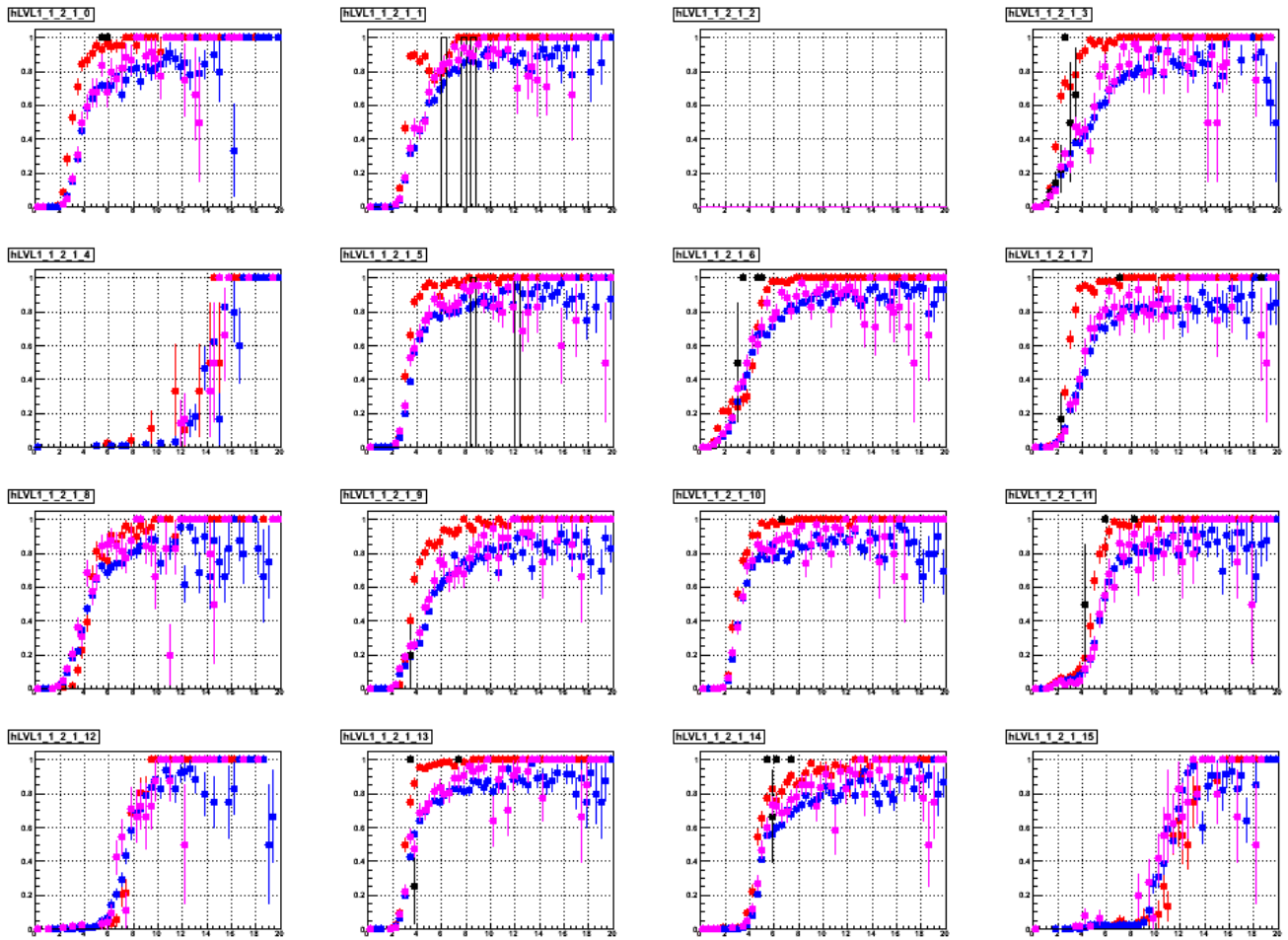
ERT-RICH: ES0

- Upper left of ES. Board Number = 21. Vth=920
- No dead channles
- Hot channels: 8 (from 385408)



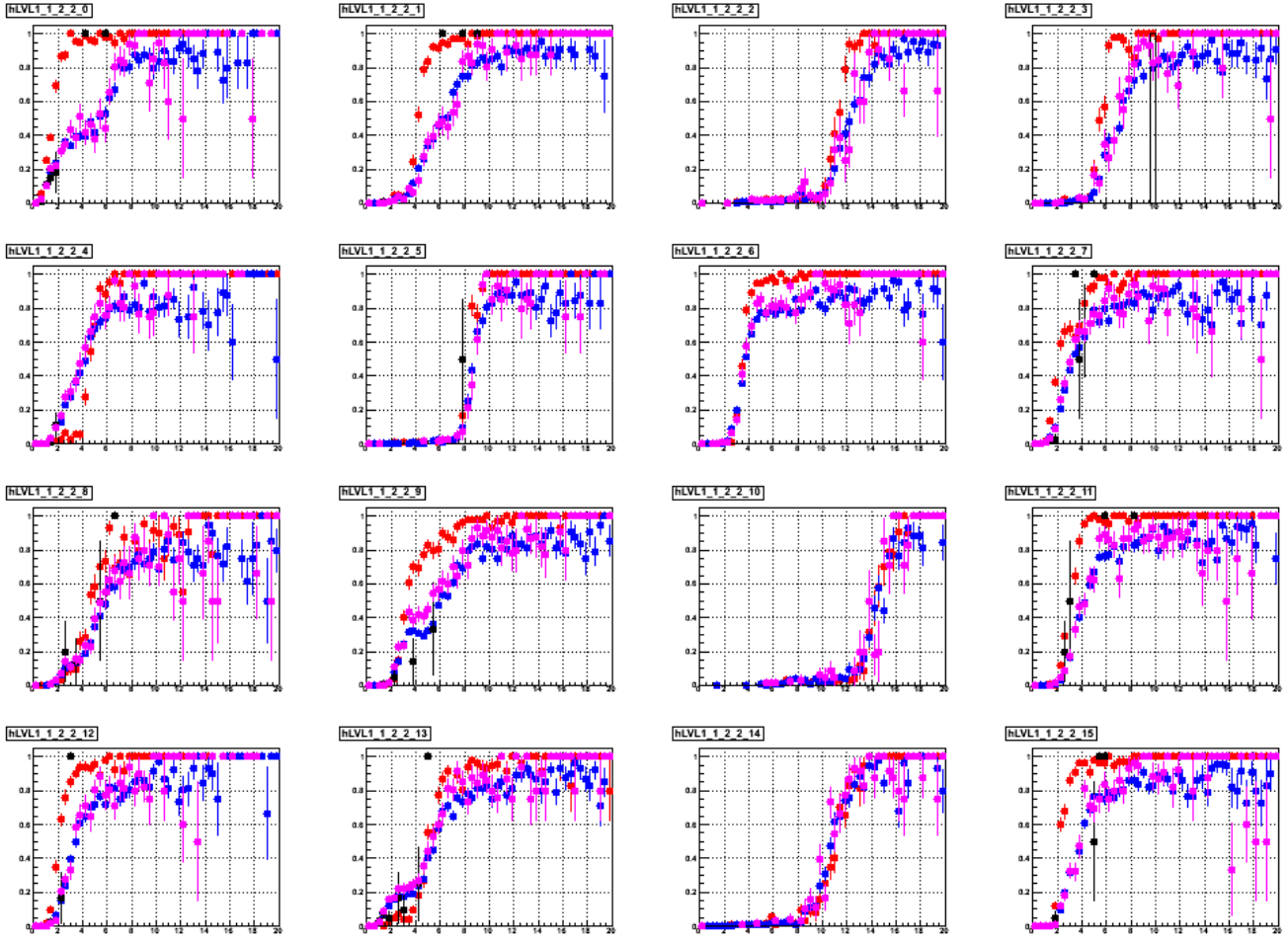
ERT-RICH: ES1

- Upper right of ES. Board Number = 02. Vth=920
- No data channles = 2, 4 (385355, either)
- No hot channels



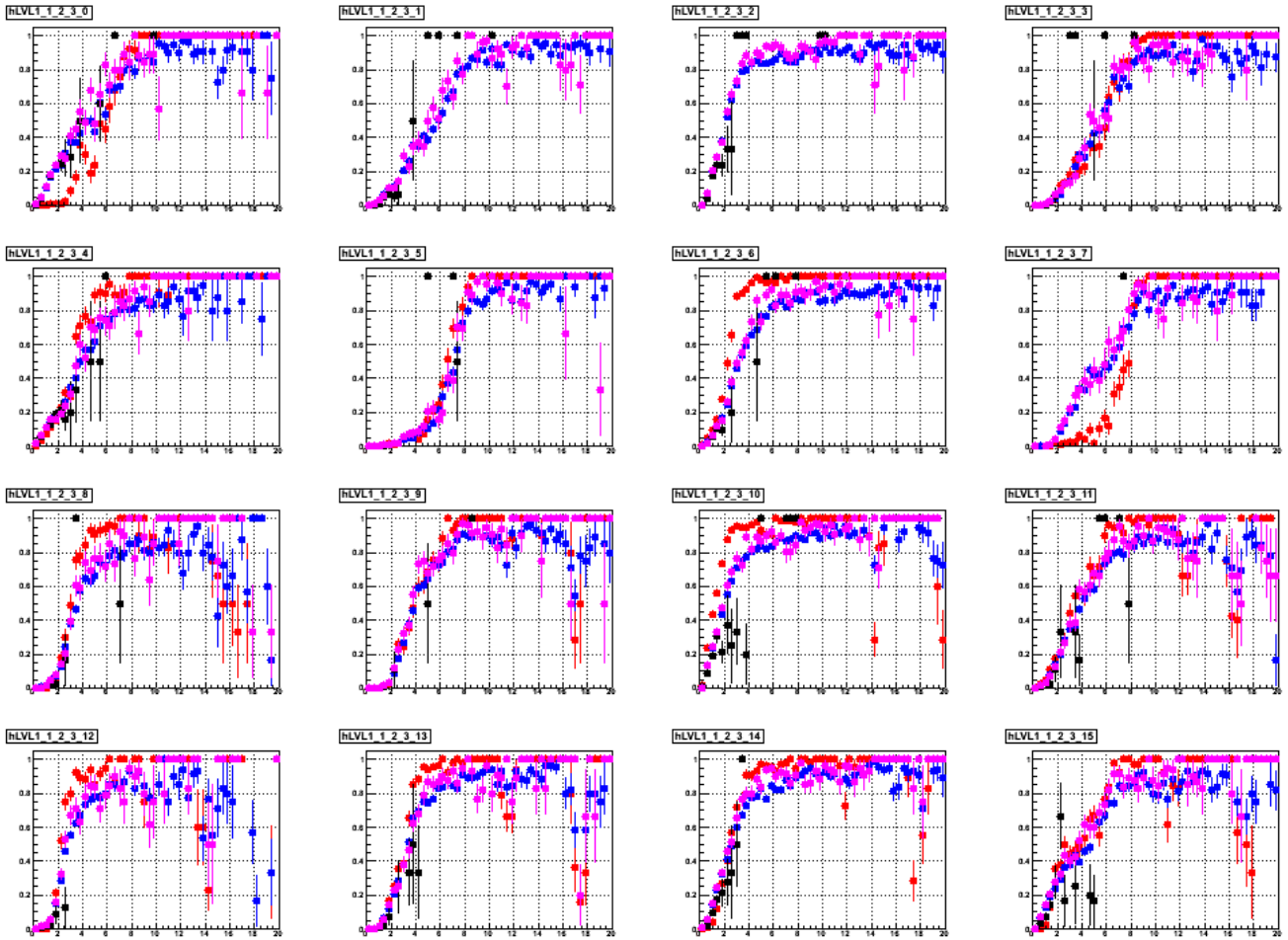
ERT-RICH: ES2

- Lower left of ES. Board Number = 05. Vth=920
- No dead channles and no hot channels



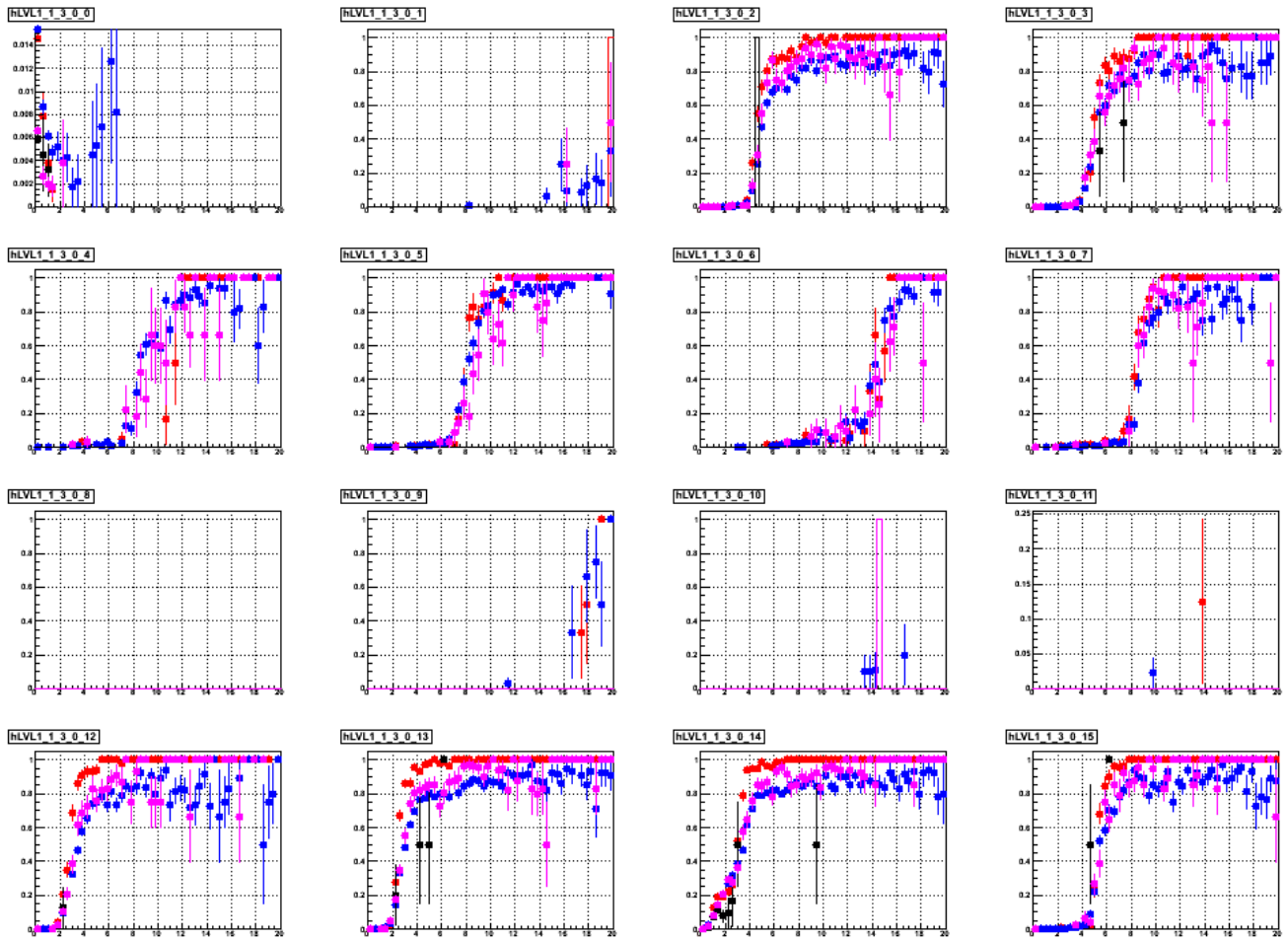
ERT-RICH: ES3

- Lower right of ES. Board Number = 16. Vth=920
- No data channles = 1, 2 (due to mask in 385230.)
- No hot channels. (1, 2 can be unmasked.)



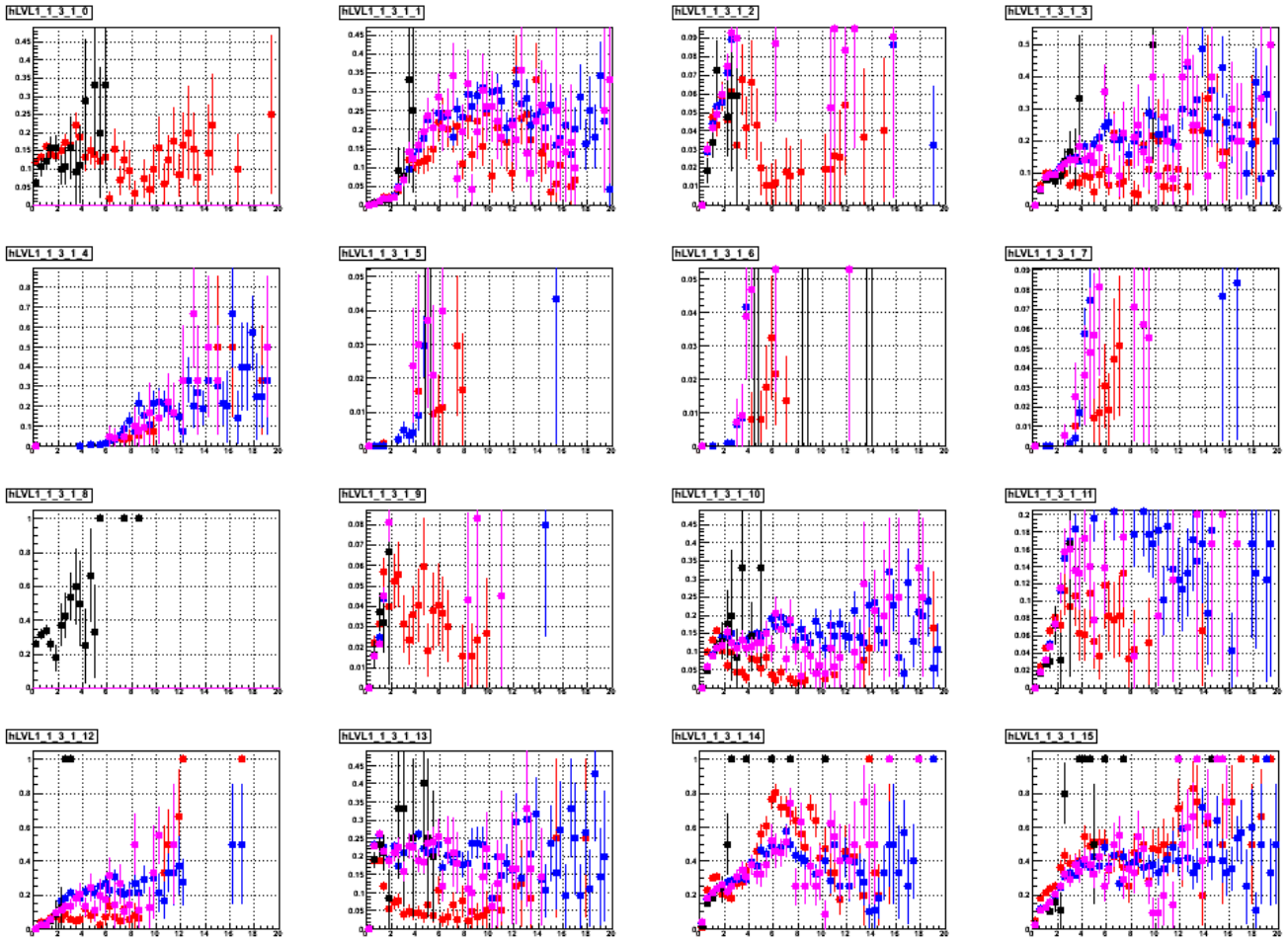
ERT-RICH: EN0

- Upper left of EN. Board Number = 11. Vth=920
- No functional channles = 0, 1, 4, 8, 9, 10, 11
- No hot channels



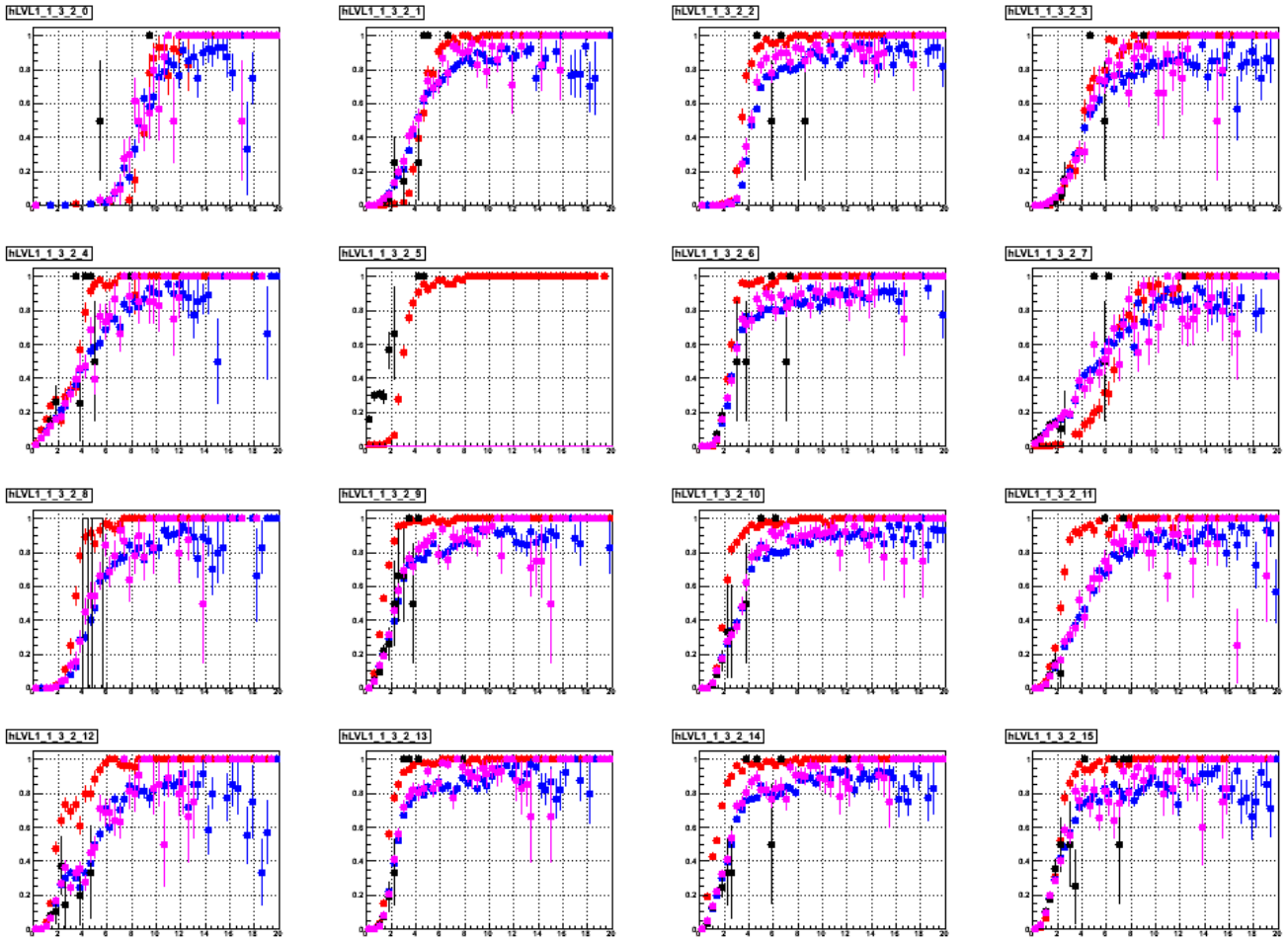
ERT-RICH: EN1

- Upper right of EN. Board Number = 12. Vth=920
- No functional channels = ALL? (ch8 is masked in 385230)
- hot channels = 0, and 8 (from 385408)



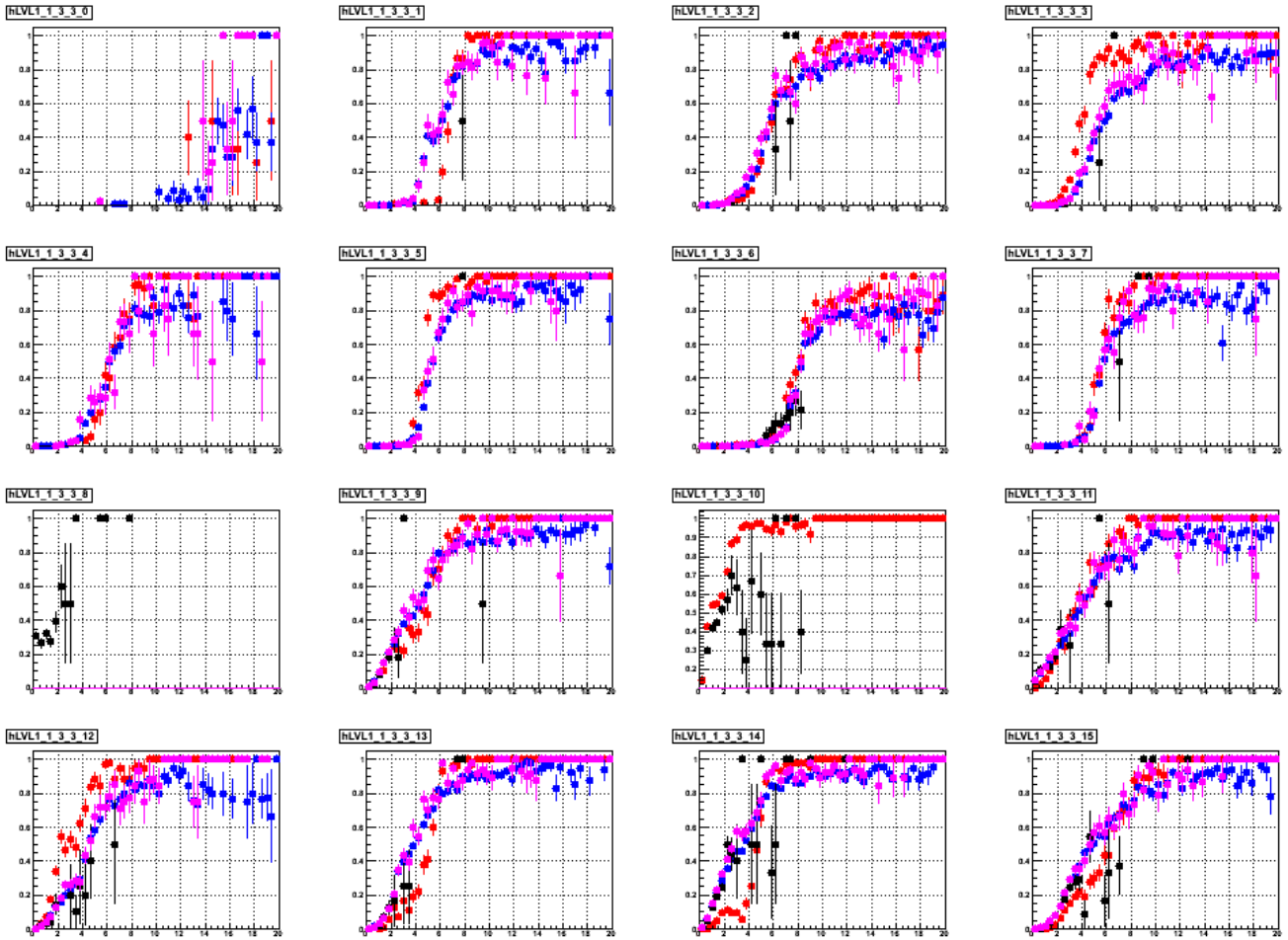
ERT-RICH: EN2

- Upper right of EN. Board Number = 10. Vth=920
- No dead channles
- Hot channels = 5 (from 385408)



ERT-RICH: EN3

- Upper right of EN. Board Number = 06. Vth=920
- No readout channles = 0, 8. (8 is masked in 385230)
- Hot channels = 8, 10 (from 385408)



ERT-RICH: Summary

- The number of non-functional channels = 34 (13.2%)
- Low efficiency channels = 15 (5.9%)
- High threshold channels = 6 (2.3%)
- Hot channels = 16 (6.3%)

Backup: Hopefully Useful Memos

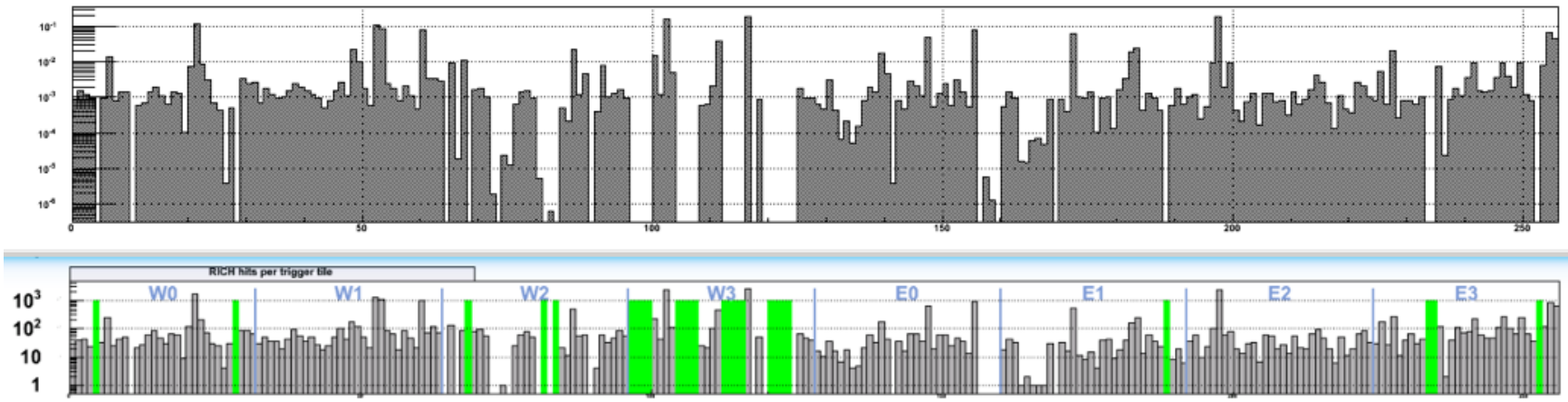
Correspondence of ERT-RICH-SM and trigger channels

- "SM" is the unit for ERT. However, trigger channel is quite convinient for us.
- Summary of correspondence between RICH trigger channel and SM.
- RICH trigger channel $\longrightarrow$ SM number.

```
//sect = ws(0), wn(1), es(2), en(3)
//trig_board = upper left(0), upper right(1), lower left(2), lower right(3)
// channel = 0 to 15 from RICH-trigger board
int get_sm_number(int sect, int trig_board, int channel){
 /// for ws, en
 int smcoordrichB[16]={12, 13, 14, 15,
                       4, 5, 6, 7,
                       28, 29, 30, 31,
                       20, 21, 22, 23};

 /// for wn, es
 int smcoordrichA[16]={11, 10, 9, 8,
                       3, 2, 1, 0,
                       27, 26, 25, 24,
                       19, 18, 17, 16};

 int arm=0;
 if(sect==0 || sect==1){
   arm = 0;
 }else{
   arm = 1;
 }

 int base_pos = 32*trig_board + 128*arm;
 int sm_number = 0;

 if(sect==0 || sect==3){
   /// use smcoordrichB
   sm_number = smcoordrichB[channel];
 }else{
   /// use smcoordrichA
   sm_number = smcoordrichA[channel];
 }

 return base_pos + sm_number;
```

Correspondence of ERT-RICH-SM and trigger channels

- Routine of *get_sm_number* gives RICH trigger channels → SM mapping in ERT online monitoring.
- Upper: my *get_sm_number* coding with ERTLL1.exe job
- Lower: ERT online monitoring (smaller statistics)



Correspondence of ERT-RICH-SM and trigger channels

- From SM number to RICH-ERT trigger channel.
- This can be useful to understand which channel is hot or dead from ERT online monitoring and DMUX file + mask checker (online_distribution/ERT_tools/maskcheck in CVS)
  - arm: West(0), East(1), side: South(0), North(1)
  - board: UL(0), UR(1), BL(2), BR(3)

```
//ert_sector = W0(0), W1(1), W2(2), W3(3), E0(4), E1(5), E2(6), E3(7)
void decode_sm2channel(int ert_sector, int sm_number){
 int arm = ert_sector/4;  ///0:west, 1:east
 int sector = ert_sector%4; ///0:sect0, 1:sect1, 2:sect2, 3:sect3

 int smcoordmodeA[32]={7, 6, 5, 4,
                       4, 5, 6, 7,
                       3, 2, 1, 0,
                       0, 1, 2, 3,
                       15, 14, 13, 12,
                       12, 13, 14, 15,
                       11, 10, 9, 8,
                       8, 9, 10, 11};

 int side = 0; //0: south, 1: north
 if((sm_number/4)%2==0){
   side = arm ? 0 : 1;
 }else{
   side = arm ? 1 : 0;
 }

 int channel = smcoordmodeA[sm_number];

 cout<<"arm = "<<arm<<" : side = "<<side<<" : board = "<<sector<<" : channel "<<channel<<endl;

}
```

Codes for Run13

- No changes in codes. checkout from repository
  - *cvs co online/monitoring/crk*
- RICH
  - phnxrich:/home/phnxrich/RUN13/crk/batch_monitor
  - *RichBatchMonitor.exe -n [number of events] -o (output file) (input prdf file)*
- ERT-RICH
  - phnxrich:/home/phnxrich/RUN13/crk/ERTRICH
  - *RICHLL1.exe -n [number of events] -o (output file) -r (rich input prdf) -e (ert input file)*
- ERT-RICH Mask
  - *cvs co online_distribution/ERT_tools/maskcheck*
  - phnxrich:/home/phnxrich/RUN13/maskcheck